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The effects of low intensity burn on population size, predation rates, and prey abundance in the striped plateau lizard (Sceloporus virgatus)

sabrina e. duncan
sduncan@pugetsound.edu

The effects of low intensity burn on population size, predation rates, and prey abundance in the striped plateau lizard (*Sceloporus virgatus*)

Sabrina Duncan, Advisor: Dr. Stacey Weiss
University of Puget Sound and Southwestern Research Station

Introduction

- **Forest fires are important events that can have both short term negative effects and long term positive effects (Fenner et al., 2007) on the ecosystem.**
- The short term effects of forest fires have shown a decrease in overall population sizes due mostly to habitat loss (Fenner et al., 2007), while the long term effects have shown an increase in species diversity due to the change in flora and fauna as well as an increase in microhabitats (Griffiths and Bull, 1996).
- It is important to study the effects of fires on population dynamics because not only are they caused naturally, but burnouts are also used as methods for conservation in order to benefit the fauna in forests (Knox et al., 2001).
- In the Chiricahua mountains of SE Arizona forest fires have led to prescribed back burning in order to stop high intensity fires from spreading. There are now habitats that contain low intensity burns such as grasses and fallen logs but still contain trees. For these reasons it is the perfect place to study the effects of low intensity burning on organisms such as lizards and compare them to nearby areas that are still intact.
- **This study will use the striped plateau lizard (*Sceloporus virgatus*) to study the effects of low intensity burning on population size, predation rates, and prey abundance.**

Questions and Predictions

1. **How has the population of *S. virgatus* been affected by low intensity burns?**
   - The population of *S.virgatus* will have decreased due to loss of habitat and possibly prey abundance
2. **What is the effect of low intensity burning on the predation of lizards?**
   - There will be greater predation/disturbance on lizards in burned leaf litter than in non-burned leaf litter.
3. **What is the effect of low intensity burning on the prey abundance of *S. virgatus*?**
   - There will be greater insect abundance in non-burned leaf litter than in burned leaf litter.

Methods

- Study conducted at Southwestern Research Station (SWRS) near Portal Arizona in the Chiricahua Mountains. A riparian zone with low intensity back-burn (John Hands) was used as well as an unburned riparian zone with similar habitat (North Fork).

- **Population size:** Individuals were captured, given individual toe-clip numbers, and marked based on sex and age. Petersen's mark and recapture method was used to estimate population sizes, which were then compared with pre burn data collected in 2008, 2009, and 2010.
- **Predation:** Forty-nine pairs of clay model lizards were placed every 20 meters along a transect. Pairs were 5 meters apart from each other in burned and unburned leaf litter. Models were left for 48 hours and then collected. The markings left in the clay by potential predators were recorded.
- **Prey abundance:** Clay model lizards were replaced with pairs of sticky aphid whitefly traps. Twenty pairs of traps were put out in the mornings and collected in the evenings. For each trap, the total number of insects in each insect order were recorded.

Results: Populations of *S. virgatus*

Population sizes decreased from 2010 (pre burn) to 2011 ($p<0.05$) (fig. 1). Female populations decreased from 2008 and 2009 to 2010 and 2011 ($p<0.05$). Similarly, female populations decreased from 2010 to 2011 (fig. 2).

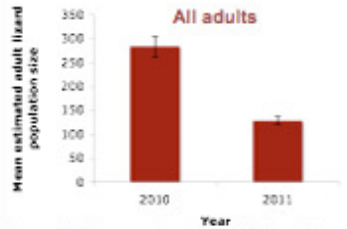

Figure 1. Mean estimated adult lizard population pre and post-burn. There was a significantly greater number of lizards in 2010, pre-burn than in 2011, post burn ($t=9.47$, $df=20$, $p<0.05$). Error bars represent standard error.

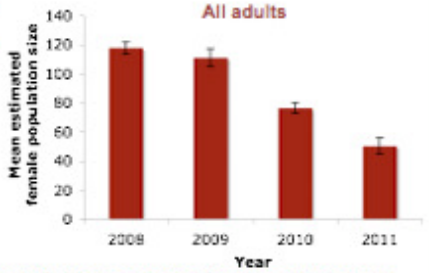

Figure 2. Mean estimated female population over four years. There was a significant difference in the female population over the four-year span ($F=43$, $df=3,50$, $p<0.05$). There was a significantly greater population size in 2008 and 2009 than in 2010 and 2011 ($p<0.05$). There was a significantly greater population size in 2010 than in 2011 ($p<0.05$). Error bars represent standard error.

Results: Predation and Disturbance

There was greater predation/disturbance on lizard models in non burned leaf litter than burned leaf litter (χ-square=6.52; $df=2$; $p<0.038$) (table 1), however two expected values were <5 in the statistical analysis.

Table 1. Predation rates on clay model lizards in burned and unburned leaf litter.

	Predation/ disturbance	no marks	total
burned	7	41	48
not burned	10	34	44

Results: Prey abundance

There was no significant difference in the prey abundance between the burned and non burned leaf litter in the burned site ($t=1.09$, $df=19$, $p>.05$) (fig. 3), however there was a significant difference between insect orders in the burned and unburned leaf litter (χ-square=11.18; $df=3$; $p<0.05$) (table 2).

Table 2. Most common insect orders in burned and non burned leaf litter. There was a significant difference in the abundance of each insect order in each set of leaf litter ($p< .05$)

	Diptera	Thysanoptera	Hymenoptera	Unidentified/other
Burned	49	90	4	83
Unburned	81	101	18	83

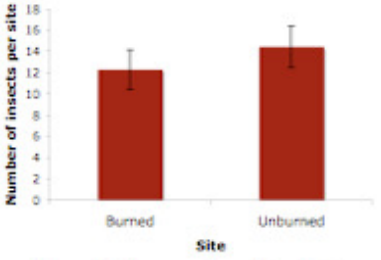

Figure 3. Mean number of insects in burned and unburned leaf litter. There was no significant difference in overall number of insects ($p>0.05$). Error bars represent standard error.

Discussion and future work

- While there was a decrease in adult population size in 2011 due to the fire, there was also a decrease in population size between 2009 and 2010. This shows us that although the fire had a negative effect on the population size, there are other factors that influence population sizes. This could be due to a change in weather patterns, an increase in predation, a decrease in prey availability, etc. It would be interesting to look at weather data to see if there was a change in patterns and caused the population to decrease in 2010. In the future, continuing censusing will be important to see if population sizes will increase again and if so, how many years this would take.
- There was greater predation/disturbance in non-burned leaf litter than in burned leaf litter. Although to the human eye it is much easier to see a lizard in burned leaf litter than non burned leaf litter this may be different to predators such as snakes and birds. Many of the markings on the models were small scratches so it is difficult to separate predation from markings made by animals too small to be a predator. In order to better understand the relationship between fire and predation on lizards it would be important to use a greater number of lizards and set up camera traps to see what is disturbing the lizards.
- There was no difference between the abundance of insects in the burned and non burned leaf litter however insect orders differed. One possibility insect abundances did not differ in burned and non burned leaf litter is that although patches are unburned, the heat from the fire could still affect the unburned areas creating edge effects. Insect traps from a separate unburned site will be compared to the insect traps from the burned site.
- **Although forest fires may decrease populations they are important biological events that are important to plants and animals and increase biodiversity.**

Literature Cited

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